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Real interest rates, inflation and the open economy: A regime-switching perspective on Australia and New Zealand ☆

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ABSTRACT

We investigate the time-series properties of Australian and New Zealand real interest rates within a Markov-switching framework. This enables us to identify characteristics in real interest rate behavior hitherto unacknowledged. We find that rates switch between alternative stationary regimes characterized by differing means, speeds of mean-reversion and volatility. For New Zealand, high rates of inflation increase the probability of remaining in a regime characterized by a faster speed of adjustment. Further application of this methodology considers the real interest rate differential between Australia and New Zealand and points to differing regimes based on volatility rather than persistence.

1. Introduction

For a number of key reasons, the time-series behavior of real interest rates has constituted a keen area of research. A stationary real interest rate is consistent with a long-run Fisher effect which in turn implies that monetary policy does not exert long- run real effects on the macro-economy. In virtually all macro models where money matters, the primary real effect of monetary policy operates through real interest rates. If the real interest rate is truly policy invariant, then these models could be in direct conflict with the empirical facts. Furthermore, in macro models where deficits have real effects, fiscal expansions raise real interest rates and crowd out private spending. If it is an empirical regularity that the real interest rate is policy invariant, the credibility of these macro models is questionable (Caporale & Grier, 2000). A further consideration is with regard to financial models because the finding of a non-stationary real interest rate is problematic for consumption-based asset-pricing models. For example, Lucas (1978), Hansen and Singleton (1982) and others consider the problem of choosing an optimal consumption sequence. The first-order condition for this problem is the intertemporal Euler equation. However, this condition cannot be satisfied if stationary consumption growth is combined with a non-stationary real interest rate.

There exist many recent studies that investigate the time-series properties of the real interest rate (see, *inter alia*, Caporale & Grier, 2000; Kapetanios, Shin, & Snell, 2003; Meade & Maier, 2003; Malliaropulos, 2000; Million, 2003; Mills & Wang, 2003; Lai,

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2004; Rapach & Weber, 2004; Rapach & Wohar, 2005; Caporale & Grier, 2005; Phillips, 2005). As discussed in the following section, these studies consider stationarity in the context of regime shifts and structural breaks, long-memory processes, non-linear mean-reversion and procedures that are designed to enhance test power.

The contribution of our paper is to test for real interest rate stationarity within a Markov-switching framework. Existing studies that include Garcia and Perron (1996), Gray (1996), Ang and Bekaert (1998, 2002) and others explore the persistence of interest rates within a regime-switching framework. In this paper, we build on the contributions made by these studies by considering the behavior of Australian and New Zealand interest rates. A Markov-switching approach offers valuable new insights into real interest rate behavior where regime-dependent episodes of stationarity or non-stationarity can be identified and analyzed. This is in contrast to existing studies that compute a single test statistic for testing non-stationarity across the entire study period. This approach can lead to a bias towards accepting the non-stationary null thereby rejecting stationarity, or give a false impression of the speed of adjustment towards long-run equilibrium, because there is no distinction between alternative stationary regimes.

We also make two further contributions to the understanding of real interest rate behavior. First, we provide a new perspective on real interest rate adjustment by considering the influence of inflation on the speed of mean-reversion. In their seminal work, Ball, Mankiw, and Romer (1988) identified a positive association between the rate of trend inflation and the slope of the output-inflation trade-off. A weaker association between aggregate demand shocks and real output can arise because higher rates of trend inflation penalize agents for not adjusting their prices. In the context of our study, relatively high real interest rate persistence is consistent with relatively high short-run potency of demand-side policy. Within our Markov regime-switching framework, support for the New Keynesian perspective on policy effectiveness can be found where increases in inflation shift the real interest rate towards the regime of low persistence.

A second contribution we provide is an insight into the changing nature of economic and financial integration between countries. Using the Markov regime-switching framework, we assess the extent to which real interest rate parity between Australia and New Zealand is subject to regime-switching. As before, we consider regimes based on persistence where, for example, low persistence of the real interest rate differential indicates closer integration.

The paper is structured as follows. The following section considers the recent literature on real interest rate stationarity. The third section discusses the methodological approach. The fourth section discusses the data and results. We find that the New Zealand real interest rate has switched between alternative stationary regimes of high and low persistence. There is evidence that higher inflation increases the probability of the New Zealand real interest rate remaining in a low persistence regime. By contrast, further analysis involving the Australia–New Zealand real interest rate differential indicates that the degree of persistence is regime-invariant. The final section concludes.

2. Recent literature

For many investigations, a key starting point is the controversial paper by Rose (1988) who provides evidence that the US real interest rate is non-stationary on account of a nominal interest rate that is $I(1)$ and inflation rate that is $I(0)$. This paper spawned a range of further investigations into the factors that might drive the apparent non-stationary characteristic. Early work includes Bonser-Neal (1990) who examines various countries to test whether changes in expected real interest rates are related to monetary regime changes in a systematic manner. The results show that while real interest rates have not been constant across monetary regimes, the characteristics of the shifts in real interest rate processes differ across countries.

More recently, Malliaropulos (2000) finds that US real interest rates are trend-stationary with a structural break in both the unconditional mean and the drift rate of a deterministic trend, which occurs shortly after the change in operating procedures of the Fed in September 1979. Million (2003) employs unit-root tests that rely on structural breaks in the deterministic part while combining this method with an efficient unit-root test. Empirical results reject a stochastic trend for the US short-term real interest rate from 1951 to 2000. This is consistent with an *ex-ante* real interest rate constant over time. Mills and Wang (2003) find evidence in favor of a small number of regime shifts, apart from which the average level of the real interest rate remained stable. They conclude that, like the United States, European real interest rates have generally been stable, only shifting in response to occasional external shocks. Lai (2004) finds that the real interest rate may appear non-stationary when in fact it is stationary and a process shift is responsible. The allowance for a simple mean shift is adequate to reject the unit-root hypothesis for both real pre- and after-tax interest rates. The mean shift coincides with the dramatic reversal of inflation psychology around late 1980 or early 1981. The timing and the cause of the structural shift identified for *ex-ante* real interest rates differ from that for *ex-post* real interest rates discussed in previous studies.

Several recent papers agree on the existence of significant regime shifts in the U.S. real interest rate, but disagree on the proximate causes of the shifts. Caporale and Grier (2000) point to large political changes as correlates, while Rapach and Wohar (2005) show that real interest rate breaks are correlated with inflation regime shifts and argue that the inflation regime changes cause the real interest rate shifts. Caporale and Grier (2005) show that controlling for the timing of changes in the inflation regime and dummy variables representing either a party change in the Presidency or a change in the identity of the Fed Chair are still strongly significant for explaining real interest rate fluctuations. Felmingham and Mansfield (2003) investigate the stationarity of Australian real interest rates and surveys over the period 1993–2001. They find that the real yields on Australian 2-, 5-, and 10-year bonds are stationary in levels. In contrast, the real overnight cash and bank-accepted bills 90-day interest rates are stationary being subject to structural breaks and are therefore viewed as susceptible to domestic policy changes and international influences.

Other types of tests consider low test power. For example, Rapach and Weber (2004) employ Ng and Perron (2001) unit-root tests and argue that nominal interest rates and inflation are both $I(1)$ variables. They find that a lack of cointegration between nominal interest rates and inflation accounts for a non-stationary real interest rate. This provides support for the Rose (1988)